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Explaining the U.S. Export Boom

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This paper assesses the performance of U.S. exports in the later part of the 1980s and finds that it cannot be fully explained by key variables that are generally believed to determine the demand for U.S. exports: the nominal trade-weighted dollar, relative inflation, and foreign GNP growth.

The unexpectedly robust performance of U.S. exports partly reflects improvements in the competitiveness of U.S. exporters that are not captured by the trends in inflation in the U.S. and abroad. In particular, U.S. export price increases in the 1980s fell below the rate of inflation in the U.S., apparently as a result of a change in the pricing behavior of U.S. exporters.

For much of the 1980s, there was widespread pessimism about the outlook for U.S. exports. U.S. exports declined over the period 1980–85. Given the widespread perception of lagging productivity growth and a lack of competitiveness in U.S. manufacturing,[1] dramatic improvements in U.S. export performance were not expected.

As a result, the robust performance of U.S. exports at the end of the last decade surprised a number of observers. Real U.S. exports of goods and services grew at a compound annual rate of 12.5 percent between 1985–89, well above the 8.1 percent average growth of the 1970s. Furthermore, the growth in exports was not confined to the period of dollar depreciation between 1985 and 1987. Exports grew nearly 14 percent in 1988, and 10 percent in 1989, even as the dollar appreciated between early 1988 and the third quarter of 1989.

This paper assesses the performance of U.S. exports up to 1989 and finds that it cannot be fully explained by key variables that are generally believed to determine the demand for U.S. exports: the nominal trade-weighted dollar, relative inflation, and foreign GNP growth. Three possible explanations for the tendency to underpredict exports are examined. First, exports of services may have grown unusually fast in relation to exports of goods. Second, recent efforts by Japan, Taiwan and South Korea to increase access to their markets have contributed to an increase in U.S. exports to these economies that is not captured by the standard determinants of export demand. Third, there has been a tendency to understate the competitiveness of U.S. exporters, because of changes in their pricing behavior.

The paper is organized as follows. Section I reviews the determinants of U.S. export demand and assesses their ability to predict exports in recent years. Section II evaluates the role of services exports in explaining the behavior of total exports. Section III examines whether recent efforts by rapidly growing Asian economies to liberalize imports may have contributed to the inability to explain the growth in U.S. exports. Section IV discusses the possibility that pricing behavior in the U.S. export sector may have changed, and Section V examines the implications of the pattern of export pricing for U.S. competitiveness and the ability to predict exports. Section VI offers some conclusions.

I. The Determinants of U.S. Exports

Two main factors are generally believed to determine the change in the demand for U.S. exports: the competitiveness of U.S. exporters, which is influenced by the U.S. dollar and relative inflation rates, and the overall demand for goods abroad, which is influenced by the GNP growth of major U.S. trading partners. Table 1 shows the behavior of these determinants of export demand in the 1970s and 1980s.

Table 1 suggests that in the first half of the 1980s, U.S. export growth was limited by the sharp appreciation of the dollar and a slowdown in foreign GNP growth in comparison to the 1970s. These trends were largely reversed in the second half of the 1980s. In particular, the growth of U.S. exports in recent years appears to be partly the result of the lagged effects of the depreciation of the dollar between 1985 and 1987 and of an acceleration in the growth of U.S. trading partners since 1985. It may also be noted that in the first half of the 1980s, U.S. inflation remained on average below foreign inflation, contributing to U.S. export competitiveness. In contrast, an acceleration in U.S. inflation above inflation abroad adversely affected the competitiveness of U.S. exporters in the second half of the 1980s.

While Table 1 highlights some of the factors that may have contributed to recent U.S. export performance, it cannot tell us whether these factors fully account for recent export growth. To shed some light on this question, the demand for U.S. exports of goods and services was modeled as a function of the exchange rate-adjusted ratio of U.S. to foreign prices, or the real exchange rate (as a proxy for U.S. competitiveness) and to foreign GNP (as a proxy for foreign demand). This model of export volume was expressed in log first-difference form, with the (one quarter) lagged levels of the explanatory variables and the respective dependent variables on the right-hand side of each equation. This representation, also known as an "error-correction" specification, is shown in equation (1):

$$\Delta XGS = \alpha + \sum_{i=0}^{m} \beta_i \, \Delta RXR_{1\,t-i} + \sum_{i=0}^{m} \gamma_i \, \Delta FGNP_{t-i} + \sum_{i=1}^{m} \delta_i \, \Delta XGS_{t-i} + \eta_1 \, RXR_{t-1} + \eta_2 \, FGNP_{t-1} + \eta_3 \, XGS_{t-1} \qquad (1)$$

where

XGS = real exports of goods and services, NIPA basis

RXR_1 = real exchange rate = $\dfrac{NXR \times P_{US}}{TWFCPI}$

NXR = Nominal trade-weighted dollar

P_{US} = U.S. fixed-weight GNP price index

$TWFCPI$ = trade-weighted CPI of 10-major industrial countries

$FGNP$ = trade-weighted GNP of 10 major industrial countries

The error-correction specification used in equation (1) has three desirable features: (1) it avoids the possibility of spurious correlation among strongly trended variables; (2) long-run relationships which may be lost by expressing the data in differences are captured by including the lagged levels of the variables on the right hand side; and (3) the specification can distinguish between short-run (first differences) and long-run (lagged levels) effects.

To test the ability of competitiveness and demand factors to explain recent export behavior, equation (1) was estimated from 1972:4 through 1987:4 and an out-of-sample simulation was performed for the period 1988:1 to 1989:4. The sample was broken in 1987:4 because the dollar reached its most recent trough in that quarter.[2] The coefficients and summary statistics from the estimation of equation (1) are reported in a later section. We focus on the

Table 1

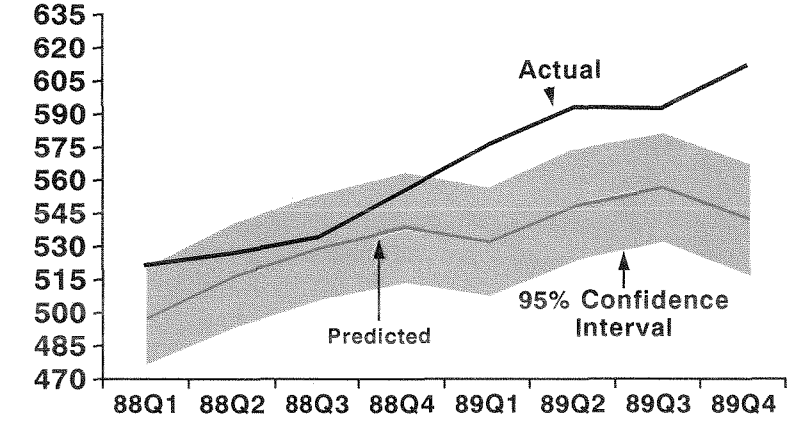
Growth Rates of Factors Affecting the Demand for U.S. Exports

(compound annual rates)

	Change in the Dollar[1]	Relative Inflation (U.S.–Foreign)[2]	Foreign GNP Growth[3]
1970–75	−4.0	−3.2	3.0
1975–80	−2.4	−1.5	3.2
1980–85	10.4	−1.2	1.9
1985–89	−8.9	1.2	3.2
1985–87	−17.7	1.1	2.6
1987–89	0.8	1.3	3.8

[1]Nominal trade-weighted average value of the U.S. dollar against the currencies of 10 major industrial countries (Japan, Germany, France, U.K., Canada, Italy, Netherlands, Belgium, Sweden and Switzerland).
[2]Inflation in U.S. fixed-weight GNP deflator versus inflation in trade-weighted CPIs of 10 major industrial countries.
[3]Trade-weighted average of growth of 10 major industrial countries.

Chart 1
U.S. Real Exports of Goods and Services
Actual vs. Predicted



results of the simulation here. Chart 1, which compares the path of actual and predicted exports, shows that the export equation did not fully anticipate the robust performance of the U.S. export sector in 1988 and 1989. Over that period, there was a systematic and growing underprediction of the level of real exports of goods and services, so that by 1989, the out-of-sample forecast was outside the 95 percent confidence range. Thus, factors other than changes in the dollar, relative inflation, and growth abroad appear to have contributed to export growth in the latter part of the 1980s.[3]

Three explanations may be offered for the tendency of equation (1) to underpredict exports of goods and services over that period. First, exports of services, which are included in the left-hand-side of equation (1), may have grown faster than expected in response to variables (such as rising interest rates abroad) other than the real exchange rate and foreign GNP.

Second, recent efforts by Japan, Taiwan and South Korea to increase access to their markets have contributed to an increase in U.S. exports to these economies. As a result, the coefficients on foreign GNP in equation (1) may be unstable.

Third, the improved competitiveness of U.S. exporters may not have been fully reflected in movements in the dollar or in U.S. inflation, which are the basis for the competitiveness measure used in equation (1).

II. Exports of Services, Not Goods?

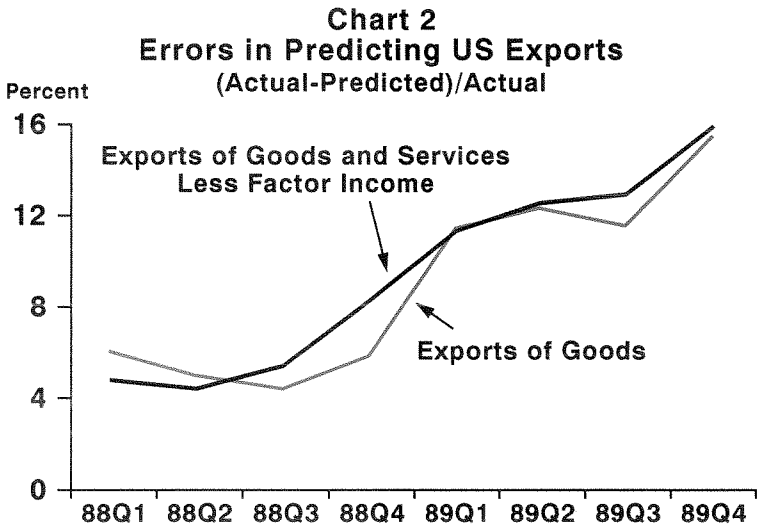
A possible explanation for the underprediction of exports towards the end of the 1980s is that in Section I, a single export equation is used to forecast exports of both goods and services. Since factor incomes or services may respond to variables other than the real exchange rate and foreign GNP (notably foreign interest rates), their behavior may account for the underprediction of total exports. The plausibility of this hypothesis may be examined in two ways. First, if exports of services explain the underprediction observed in Chart 1 they must have grown unusually fast in comparison to merchandise exports. Second, if exports of services contributed to the underprediction of total exports, the out-of-sample forecast of exports should improve when services are excluded.

To check the first possibility, Table 2 compares the growth in the components of real exports of goods and services. Table 2 shows that U.S. merchandise exports grew faster than U.S. exports of services in the 1980s, reversing the pattern of the 1970s, when exports of services grew faster. (As a result, the real share of U.S. merchandise exports in total exports, which had fallen from nearly 68 percent in 1970 to 62 percent in 1980, rose to nearly 66

Table 2

Growth Rates of Real U.S. Exports of Goods and Services
(compound annual rates)

	Total	Merchandise	Services	Factor Income
1970–75	7.8	7.3	8.9	9.0
1975–80	8.4	7.1	10.8	14.9
1980–85	−1.1	−0.9	−1.6	−2.7
1985–89	12.7	14.0	10.6	7.1



percent in 1989.) Thus, Table 2 does not support the hypothesis that unusually rapid growth in services accounts for the remarkable growth in exports at the end of the 1980s.[4]

To check the second possibility, equation (1) was re-estimated respectively using (i) exports of goods and services net of factor income and (ii) exports of goods as the dependent variable. Inspection of the errors, illustrated in Chart 2, indicates that the systematic and rising tendency to underpredict exports *still occurs* when factor incomes or services are excluded. Thus, the underprediction of exports does not appear to be the result of any unusual pattern in exports of services. In the discussion that follows, we will therefore continue to focus on total exports of goods and services.

III. Growing Access to Foreign Markets

In the 1980s, a number of highly successful Asian economies sought to liberalize their commercial policies and improve access to their domestic markets. The cases of Japan, Taiwan and South Korea have drawn particular attention, as all three economies experienced large trade surpluses over extended periods in the 1980s. In the case of Japan, where tariffs are low, and formal nontariff barriers are quite limited, efforts have focused on eliminating impediments to agricultural imports (for example, by eliminating prohibitions on beef and citrus imports), and lifting so-called "intangible" barriers to trade that have tended to discourage imports. In the cases of Taiwan and South Korea, steps have been taken to eliminate nontariff barriers or to replace them by tariff barriers (thus enhancing the transparency of protection, which facilitates trade), and also to lower tariff barriers.

For example, South Korea increased the percentage of goods approved for import licenses from 64 percent in 1978 to 95 percent by the late 1980s. It also adopted a plan to reduce average tariff rates progressively. Tariffs have fallen from an average of nearly 24 percent in 1983 to 19 percent in 1987 and to under 13 percent in 1989. Assuming no reversals, they are projected to fall to 7 percent by 1993. Taiwan's trade liberalization efforts have been even more extensive. In early 1989, 98 percent of the products could be freely imported. Average tariff rates, which had remained at around 31 percent from 1980 to 1984 fell to around 20 percent in 1987 and to 6.3 percent in 1989. Tariff rates are to fall to 3.5 percent by 1993.

Table 3

Growth Rates of Nominal U.S. Exports of Goods

	1970–89[1]	1987–89[2]
Japan	11.2	25.6
	(0.7)	
Taiwan	15.4	53.3
	(0.9)	
South Korea	15.7	29.0
	(0.8)	

[1]Based on time trend regression. Standard errors in parentheses.
[2]Compound annual rate.

These efforts by major Asian economies to improve access to their markets appear to have benefited U.S. exporters. U.S. nominal exports to Japan, South Korea and Taiwan grew at an unprecedented rate in the later part of the 1980s. As shown in Table 3, annual U.S. export growth between 1987 and 1989 respectively averaged 26 percent to Japan, 53 percent to Taiwan and 29 percent to Korea. This is well above historical averages. While real bilateral export data are not available, it is likely that real export growth follows a similar pattern. The rapid growth of U.S. exports to these economies implies that they accounted for a significant proportion of total U.S. export growth in the later part of the 1980s.

If the acceleration of U.S. exports to Japan, Taiwan and South Korea is due to their efforts to improve access to their economies, the explanatory power of equation (1) may be adversely affected. In particular, it may be argued that greater openness in these markets will tend to increase the responsiveness of the demand for U.S. exports to foreign GNP. To investigate this possibility, equation (1) was estimated over the period 1972–1989, with slope dummies for the foreign GNP variable beginning in 1988:1. The results are summarized in Table 4. It is apparent that there has been no statistically significant change in the response of exports to foreign GNP. Thus, a larger marginal propensity to import abroad does not explain the underprediction of U.S. exports over the past two years.

Table 4

Testing for Stability in the Responsiveness of Exports to Foreign GNP

	No. of lags	Sum of slope-dummy coefficients on Foreign GNP[1]
Short-run	0–2	0.451 (0.17)
Long-run	1	.0007 (0.15)

[1]t-statistics in parentheses

IV. A Change in Exporter Pricing Behavior?

Another possible explanation for the tendency to underpredict exports at the end of the 1980s is that the improvements in the competitiveness of U.S. exporters may not be fully reflected in the measure of competitiveness used in equation (1). The competitiveness of U.S. exporters may be measured in two different ways. One approach is to take the exchange rate-adjusted ratio of a domestic U.S. price (such as the U.S. fixed-weight GNP price) and trade-weighted foreign prices (such as foreign CPIs).[5] In this case we obtain the measure of U.S. competitiveness, or the real exchange rate, used in estimating equation (1):

$$RXR1 = \frac{NXR \times P_{US}}{TWFCPI} \qquad (2)$$

where an *increase* in RXR_1 corresponds to a real appreciation, or a *decline* in external competitiveness. An alternative approach is to construct an exchange rate-adjusted index of the price of U.S. exports relative to trade-weighted foreign prices, that is:

$$RXR_2 = \frac{NXR \times PX}{TWFCPI} \qquad (3)$$

where PX is the (fixed-weight) export deflator.

Although RXR_2 is a more direct measure of the competitiveness of U.S. exporters, RXR_1, which is based on a domestic U.S. price, is often used as a proxy for U.S. competitiveness for a number of reasons. First, RXR_1 reflects the overall competitiveness of all goods produced in the U.S. rather than of the goods that are currently produced in the export sector. A broad measure of U.S. competitiveness, such as RXR_1, accounts for the possibility that if domestic prices are sufficiently competitive, certain U.S. producers may begin producing for the U.S. export sector even if they do not do so currently. RXR_2, which is based on the export price of current exporters, does not explicitly take this possibility into account. Second, RXR_1 reflects the plausible view that in the long run, the competitiveness of U.S. exporters will largely be determined by domestic costs of production, as represented by a domestic U.S. price. Third, the use of RXR_1 is consistent with the traditional conventional wisdom regarding the market conditions that face U.S. exporters.[6] According to this view, substitutes for U.S. products in world markets historically were not readily available and exports had a limited impact on total profitability. As a result, U.S. exporters were relatively less concerned about their external competitiveness, and export prices were set primarily on the basis of domestic costs of production, rather than on conditions prevailing in export markets. In this environment, there would be a stable relationship between the U.S. export price (used in RXR_2) and the fixed-weight GNP price (used in RXR_1), and the two

measures RXR_1 and RXR_2 would give the same overall picture of competitiveness. The GNP price in RXR_1 can then be interpreted as a proxy for the export price that is used directly in RXR_2.

However, RXR_1 will give a misleading picture of the competitiveness of U.S. exporters if the relationship between the export price and the fixed-weight GNP price is not stable because of a change in the pricing behavior of exporters.

To assess whether the relationship appears to be stable, Chart 3 shows the ratio of these two prices between 1970 and 1989. I call this ratio the relative export price. As can be seen from equations (2) and (3) the relative export price is equivalent to dividing RXR_2 by RXR_1, and thus indicates whether the two measures of competitiveness behave in a similar way. If the trend in the ratio is flat, RXR_1 and RXR_2 give the same measure of competitiveness. If the ratio declines, exporters are more competitive than suggested by RXR_1; the reverse is true if the ratio rises. As a reference, the chart also shows the path of the nominal trade-weighted dollar.

The interpretation of Chart 3 is facilitated if we think of the relative export price as an indicator of the aggregate profit margin of the export sector.[7] The chart suggests that there was no trend in export profit margins in the 1970s, as there was little *net* change in the relative export price between the early and late 1970s. In contrast, a pronounced decline in the relative export price occurred between 1980 and 1985, and was not reversed subsequently.[8]

The decline in the relative export price in the early 1980s may have been partly the result of a contraction in world economic activity that reduced demand for U.S. exports and thus prompted a (cyclical) reduction in U.S. export prices. An alternative explanation, which we focus on here, is that U.S. producers may have been attempting to price more competitively in U.S. export markets. This explanation is suggested by the fact that a lower relative export price persisted after world economic activity recovered in 1983 and particularly after the dollar depreciation between 1985 and 1987 sharply reduced the foreign currency price of U.S. exports.

Such a change in pricing behavior would be consistent with growing competitive pressures caused by the entry of producers from Japan, and later the newly industrializing Asian economies in world markets previously dominated by U.S. producers, such as capital goods and electronics, beginning in the 1970s. These pressures probably intensified in the 1980s because the sharp appreciation of the dollar (see Chart 3) in the first half of the 1980s increased the price of U.S. products in foreign currencies, paving the way for further entry by Asian producers in U.S. and world markets. Furthermore, the debt crisis that began in 1982 led to stagnation in traditional U.S. exports of manufactures to Latin America, which required U.S. producers to seek out new markets.

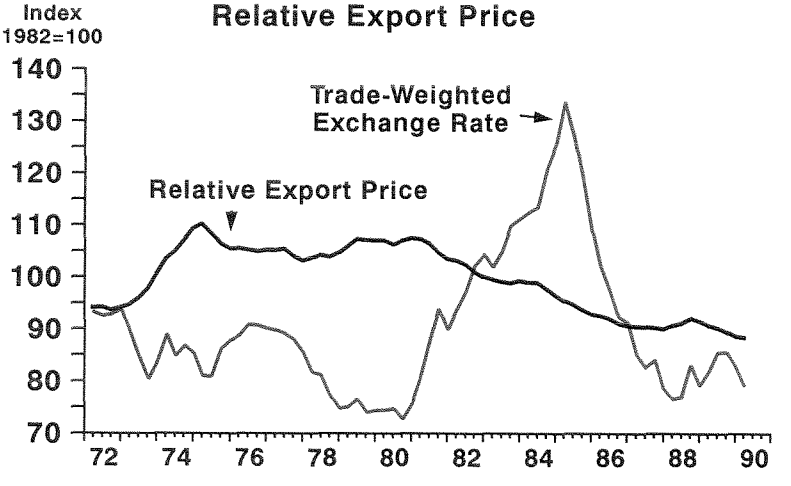
Testing for Stability in Export Pricing

The discussion in the preceding section raises the question of whether the decline in the U.S. relative export price can be detected as a change in exporter pricing behavior.

We may attempt to test more formally for such a change and attempt to identify the sources of any such change at the aggregate level, by using a model of export pricing.

Following the literature on this subject, assume that in setting the prices of traded goods, suppliers add a markup over their costs of production. The markup is in turn a function of competing goods prices, which are influenced by the exchange rate and foreign prices. The export price

Chart 3
Relative Export Price



can then be expressed as a function of the domestic GNP price (to represent domestic costs of production), and the exchange rate-adjusted foreign price (to represent foreign competition). In error-correction form, this relationship may be expressed as follows:

$$\Delta PX_t = \kappa_0 + \sum_{i=0}^{m} \mu_i \Delta P_{USt-i} + \sum_{i=0}^{m} \nu_i \Delta \left[\frac{TWFCPI}{NXR}\right]_{t-i}$$

$$+ \sum_{j=1}^{m} \xi_j \Delta PX_{t-j} + \tau_1 P_{USt-1} + \tau_2 \left[\frac{TWFCPI}{NXR}\right]_{t-1}$$

$$+ \tau_3 PX_{t-1} \qquad (4)$$

In the long run the export price will tend to rise in response to an increase in the domestic GNP price, which raises the costs of production. The export price will also tend to rise in response to an increase in the foreign price or a dollar depreciation, to the extent that U.S. producers respond to export market conditions in setting the export price.[9] The long-run coefficients in equation (4) (based on τ_1, τ_2) are thus expected to be positive. The signs on the short-run coefficients (μ_i, ν_i, ξ_j) depend on the precise pattern of adjustment.

To verify whether the response of export prices to its determinants has changed, equation (4) was estimated between 1972:1 and 1985:1, and the equation was simulated out-of-sample from 1985:2 to 1989:4. The sample was broken in 1985:1, when the U.S. dollar peaked, because in the period that followed, cyclical and exchange rate factors would tend to put upward pressure on U.S. export prices. A moderate export price response to these upward pressures, as indicated by a systematic tendency to overpredict export prices after 1985:1, would thus suggest more competitive pricing behavior on the part of U.S. exporters.

The results of the regression are reported in column I of Table 5. As can be seen, equation (4) produces a satisfactory fit and the hypothesis that there is no serial correlation cannot be rejected. In line with conventional wisdom, the regression results suggest that U.S. exporters priced mainly on the basis of domestic costs of production, and ignored the exchange rate-adjusted foreign price up to the first half of the 1980s.

Chart 4 illustrates the results of the simulation from 1985:2 to 1989:4. As can be seen, there was a tendency to *overpredict* the export price in the second half of the 1980s, which supports the view that exporters were pricing more competitively.

To identify the sources of this apparent change in pricing behavior, equation (4) was re-estimated over the period 1974:4–1989:4. Several regressions were then performed,

Table 5
Export Pricing Behavior

	No. of lags	1972:4–1985:1 I	1972:4–1989:1 II	1972:4–1989:1 III
Constant		.04	.05**	.03
		(1.1)	(2.4)	(1.5)
First differences				
ΔP_{US}	0–2	1.2**	1.3***	1.2***
		(2.5)	(3.6)	(3.4)
$\Delta(\frac{FCPI}{NXR})$	0–2	.02	−0.0004	0.03
		(0.3)	(−0.01)	(0.9)
ΔPX	1–2	0.45***	0.40***	0.43***
		(3.4)	(3.8)	(4.1)
Lagged levels				
P_{US}	1	0.10***	0.07***	0.10***
		(2.8)	(2.8)	(3.4)
$\frac{FCPI}{NXR}$	1	.01	−0.002	0.004
		(0.4)	(−0.3)	(0.5)
PX	1 or 2	−0.12***	−0.08***	−0.11***
		(−2.8)	(−3.3)	(−3.8)
Slope dummies				
PX	1			−0.002*
				(−1.8)
S.E.E.		6.4×10^{-3}	5.9×10^{-3}	5.8×10^{-3}
$\bar{R}^2$		0.79	0.82	0.82
Durbin's test for serial correlation[1]		−0.47	−0.56	−0.17
		(−0.5)	(−1.2)	(−0.3)
Long-run elasticities				
$-(\frac{P_{US}}{PX})$		0.85	0.88	0.91

Notes: t-statistics in parentheses

*** Significant at 1 percent
** Significant at 5 percent
* Significant at 10 percent

[1]Coefficient on lagged residual and associated t-test. Based on regression of current residual on lagged residual and on right-hand-side variables in export price equation.

with slope dummy variables for the period 1985:2–1989:4 on the following variables:

1) the first differences of the domestic U.S. price, the exchange-rate adjusted foreign price, and the lagged dependent variable;
2) the lagged levels of the domestic U.S. price and the exchange-rate adjusted foreign price, with and without a slope dummy on the lagged dependent variable; and
3) the lagged level of the dependent variable only.

A negative slope dummy coefficient on the domestic U.S. price variable would suggest that exporters were adjusting their export prices by less in response to changes in their costs of production, which would be consistent with growing competitive pressures.[10]

A positive slope dummy coefficient on the foreign price variable would suggest that U.S. exporters were responding to external competitive pressures after 1985, whereas they had not done so in the past.[11]

A change in the response to the lagged dependent variable is more difficult to interpret. However, a negative coefficient on the slope dummy indicates that the increase in the U.S. export price associated with its past value has fallen, which is consistent with more moderation in the pricing behavior of U.S. exporters or a change in the desired level of U.S. export prices.

Column II in Table 5 reports the results of the regression over the period 1972:4–1989:4 without any slope dummy variables. A comparison of columns I and II suggests that the long-run response to U.S. prices and to the lagged level of the dependent variable may have changed. However, it was difficult to isolate the precise nature of the change.

The slope dummy coefficients on the levels and changes of the U.S. GNP price and the exchange rate-adjusted foreign price were not significant (regressions 1 and 2 above). The results of the corresponding regressions are not reported because they are very similar to the results shown in column II.

However, there is some weak evidence that the rate at which exporters adjust their export prices in response to deviations from equilibrium, or possibly the desired level of export prices, may have changed. As shown in column III of Table 5 the coefficient on the slope dummy variable for the lagged level of the dependent variable (regression 3 above) is significant at the 10 percent level.

To sum up, the U.S. export price fell in comparison to the GNP price as the dollar appreciated in the early 1980s. This relative decline persisted even after the dollar appreciation was fully reversed over the period 1985–1987. The decline in the relative export price appears to reflect a change in the pricing behavior of exporters, but the precise nature of the change was not easy to identify or interpret. Further research is required to clarify the process governing the pricing behavior of U.S. exporters. In particular, studies of export pricing at the industry level may be necessary, as recent research of the U.S. import market suggests that aggregation problems may limit the ability to model aggregate pricing behavior.[12]

Chart 4
Export Price Index (Actual vs. Predicted)

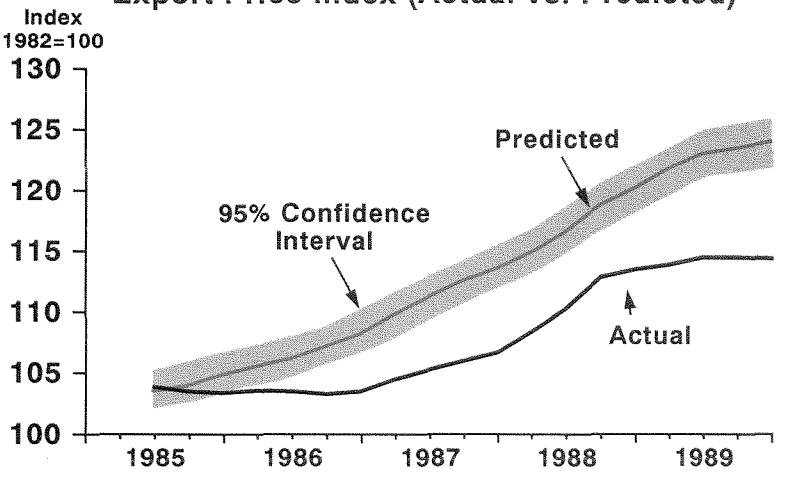
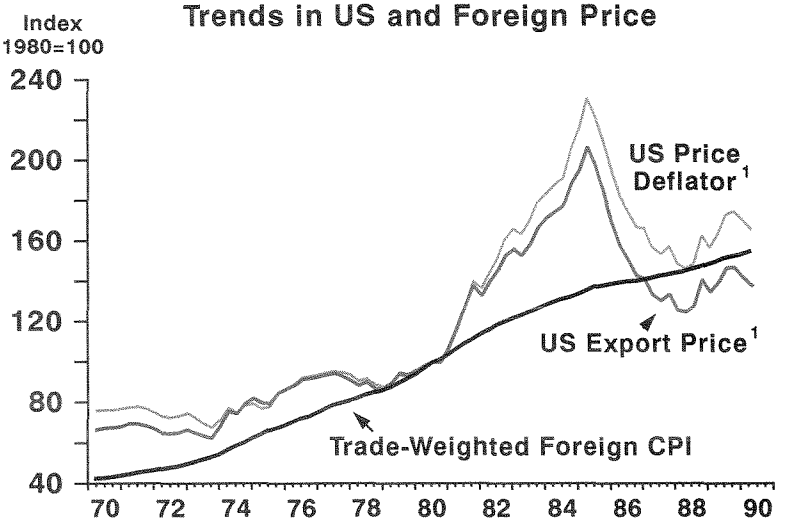


Chart 5
Trends in US and Foreign Price



[1]Expressed in foreign currency by multiplying with the Federal Reserve Board's nominal trade-weighted index of the dollar.

V. U.S. Competitiveness and Export Performance

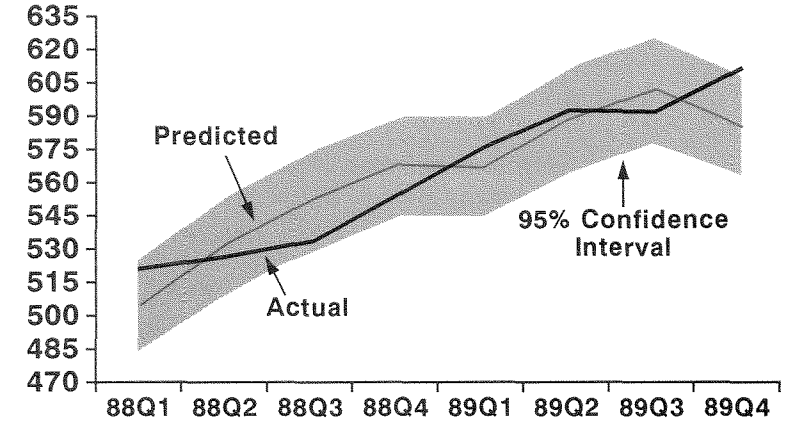
The preceding discussion suggests that a measure of U.S. competitiveness based on the export price may give a markedly different picture of U.S. competitiveness than does a measure based on the U.S. GNP price. This can be seen in Chart 5, which compares the respective paths of the U.S. GNP price and the U.S. export price, both in foreign currency, to the trade-weighted foreign CPI over the period 1970–1989. Note that fluctuations in the U.S. GNP price and U.S. export price now reflect changes in the dollar exchange rate.

The U.S. GNP price measure suggests that after adjusting for exchange rates, U.S. inflation on average exceeded foreign inflation, so that U.S. exporters were still relatively uncompetitive at the end of the 1980s. In contrast, the export price measure suggests that U.S. exporters at the end of the 1980s were better positioned to face foreign competition than they had been at any other time during the preceding twenty years.

After rising in the first half of the 1980s, the U.S. export price in foreign currency fell sharply in 1985. Even though the drop in the U.S. export price was reversed starting in 1988, the *level* of the export price was still below the level of the trade-weighted foreign CPI in 1989. Of course, comparisons of indices can be sensitive to the choice of base period (Chart 5 uses 1980 as the base year), but the conclusion that U.S. exporters are still competitive relative to their trading partners is fairly robust; any base year between 1970 and 1985 yields the same conclusion.[13]

Chart 5 suggests that the post-1985 increase in U.S. inflation relative to inflation abroad (recall Table 1) was not

Chart 6
U.S. Real Exports of Goods and Services
Actual vs. Predicted Using RXR_2



fully reflected in export prices. As a result, the measure of competitiveness based on the U.S. GNP price (RXR_1) used in equation (1) tends to understate U.S. competitiveness, while RXR_2 may give a more realistic picture of U.S. competitiveness in the 1980s. Changes in U.S. competitiveness not captured by RXR_1 may thus explain the tendency for equation (1) to underpredict U.S. exports.

To verify this last hypothesis, equation (1) was estimated over the period 1972:4–1987:4, replacing RXR_1 by RXR_2. An out-of-sample dynamic simulation was then performed for the period 1988:1–1989:4.

Table 6 compares the results of the regressions using RXR_1 and RXR_2 while Table 7 compares the out-of-sample forecasting performance over the period 1988:1–1989:4. Taken together the tables show that the in-sample performance of either measure of competitiveness over the period 1972:4–1987:4 is roughly comparable. However, when RXR_2 is used, the mean square error of the out-of-sample forecast in the last two years of the 1980s falls by 60 percent in comparison to the forecast using RXR_1. Furthermore, Chart 6 shows that using RXR_2 eliminates the systematic underprediction of U.S. exports after 1988, and that the path of actual exports now tends to remain within the 95 percent confidence band of the forecast.[14]

The ability of RXR_2 to improve the forecast of exports, in comparison to the forecast based on RXR_1, suggests that the rapid growth in exports towards the end of the 1980s was partly the result of changes in the competitiveness of U.S. exporters. This change in competitiveness was in turn apparently attributable to changes in their pricing behavior.[15]

Table 7

Out-of-Sample Forecasting Performance for Exports

1988:1–1989:4

	RXR_1	RXR_2
Mean square error[1]	36.4	14.7

[1]The mean square error was calculated by taking the average sum of squares of actual less predicted export volume in billions of 1982 dollars.

Table 6

Regression of Export Demand

1972:4–1987:4

	Lags	RXR_1	RXR_2
Constant	0	−.57*	−.97
		(−1.8)	(−3.0)
First differences			
ΔRXR	0–4	0.38	0.68**
		(1.2)	(2.5)
$\Delta FGNP$	0–4	−0.44	0.25
		(−0.2)	(0.2)
ΔXGS	1–4	0.84**	0.49*
		(2.1)	(1.8)
Lagged levels			
RXR	1	−0.16***	−0.23***
		(−2.8)	(−4.1)
$FGNP$	1	0.72**	0.69***
		(2.5)	(3.5)
XGS	1	−0.41**	−0.42***
		(−2.5)	(−3.7)
Durbin's test for serial correlation[1]		0.19	0.15
		(0.4)	(0.3)
$\bar{R}^2$		.568	.609
S.E.E.		.021	.020
Long-run elasticities			
$-(RXR/XGS)$		−0.41	−0.55
$-(FGNP/XGS)$		1.78	1.64

Notes: t-statistics in parentheses

*** Significant at 1 percent
** Significant at 5 percent
* Significant at 10 percent

[1]Coefficient and t-statistic based on regression of residual on lagged residual and right-hand-side variables.

VI. Conclusion

The rapid growth of U.S. exports of goods and services in 1988 and 1989 is not fully explained by a standard model of export demand that accounts for trends in the dollar, relative inflation rates in the U.S. and abroad and robust growth among U.S. trading partners. U.S. exports grew rapidly in 1988 and 1989 in spite of an appreciating dollar and an increase in U.S. inflation in comparison to inflation abroad.

The unexpectedly robust performance of U.S. exports partly reflects improvements in the competitiveness of U.S. exporters that are not captured by the trends in inflation in the U.S. and abroad. In the 1980s, U.S. export prices increased by less than inflation in the U.S. or (after adjusting for exchange rates) in major foreign industrial countries. Thus, the relative rate of U.S. inflation has tended to understate the competitiveness of the U.S. export sector. The empirical tests reported in this paper suggest that the deviation between export price increases and U.S. inflation in the 1980s may in turn have been caused by a change in pricing behavior on the part of U.S. exporters. However, further research at the industry level is required to confirm this hypothesis.

The findings of this paper underscore the fragility of the boom in U.S. exports that began in the late 1980s. While the relative slowdown in the rise of the U.S. export price offset the adverse impact of rising U.S. inflation on U.S. competitiveness, this offset cannot persist indefinitely. Export price increases can remain below the U.S. rate of inflation in the long run only if the productivity of the export sector consistently exceeds productivity growth in the U.S. domestic sector. There appears to be no evidence that this is occurring, and in the absence of further U.S. dollar depreciation, continued gains in U.S. competitiveness will require a reduction in U.S. inflation below the rate of inflation of its trading partners.

NOTES

1. For a recent discussion of the poor productivity performance of the U.S. manufacturing sector and the possible contribution of lagging innovation, see Baily and Chakrabarti (1988). A more optimistic interpretation of trends in U.S. productivity is offered by Baumol, Blackman and Wolff (1989).

2. Furthermore, the discussion of Chart 5 later in the text suggests that in contrast to previous episodes of dollar appreciation, U.S. exporters remained competitive in comparison to foreign producers during the dollar appreciation of 1988–89. Out-of-sample simulations of equation (1) for the period 1985:1–1989:4 also suggest that there was no systematic tendency to underpredict until 1988. These out-of-sample simulations were performed after the break-point was selected.

3. A similar conclusion is reached when the simulations are based on the export equation of the structural model of the Federal Reserve Bank of San Francisco, which uses a quadratic PDL specification. See Throop (1989). A PDL specification is also used in the export equations of the MPS model of the U.S. economy maintained by the Board of Governors of the Federal Reserve System.

4. The nominal data convey a different impression. While the growth of merchandise and services exports were roughly the same in the 1970s, in the 1980s, the value of services exports grew more rapidly than did the value of merchandise exports. As a result, the nominal share of services in U.S. exports grew from 35 percent in 1970 to 36 percent in 1980 and to 41 percent in 1989. This rising share reflects the more rapid rate of inflation in the services sector.

5. This approach is followed in the FRBSF structural model as well as the Federal Reserve Board's MPS model. The latter model uses the nonfarm business fixed-weight deflator net of indirect business taxes, in lieu of the export price, in measuring the competitiveness of the U.S. export sector. See Brayton and Mauskopf (1985), Section VII. In contrast, the Board's MCM model uses the export price in measuring U.S. export competitiveness, as in equation (3). See Helkie and Hooper (1988), Table 2-3.

6. These market conditions are discussed in Hooper and Mann (1987). Another reason the use of RXR_1 is appealing is that it eliminates the need to estimate an export price separately (the same is true on the import side). This can be useful in forecasting, particularly since specifying a stable price equation can be difficult.

7. For related measures see Hooper and Mann (1987) and Moreno (1989b).

8. Note that there also seems to be a decline in the relative export price if other price indices are used. See Moreno (1989b), which compares the nonagricultural export price to the PPI. A comparison of export unit values and the PPI yields a similar conclusion, although it may be argued that this may reflect a shift in the composition of exports towards high-productivity and low-price sectors, such as computers.

9. For an analogous equation, see the export equation of the Federal Reserve Board's Multicountry Model (MCM), described in Helkie and Hooper (1988). However, Helkie and Hooper use the non-agricultural export price on the left-hand-side and a specially constructed price index to represent domestic costs of production on the right-hand-side. Note that as in Helkie and Hooper, equation (4) assumes that exporters respond in exactly the same way to changes in the exchange rate that they do to changes in the foreign price, on the assumption that the response to changes in the exchange rate is motivated purely by the effect it may have on competitiveness in foreign markets.

10. One possible interpretation of such a result is that increases in productivity in the export sector have recently exceeded increases in overall U.S. productivity, and that exporters are passing on these gains to their customers. An informal examination of some of the industry data provides no clear indication of whether productivity gains among exporters in the 1980s have in fact exceeded productivity gains for U.S. producers as a whole. For example, in the capital goods industry-one of the most dynamic U.S. export sectors—labor productivity growth in the 1980s in semiconductors, computers and non-electrical machinery—exceeded the growth of labor productivity in manufacturing as a whole. On the other hand, labor productivity growth was below average in a number of historically important U.S. export sectors, such as construction machinery, ball bearings, machine tools and pump and compressors. For a more detailed discussion, see Orr (1989).

11. Using data at the four-digit SIC level, Hooper and Mann (1987) found some indications that U.S. producers tend to price more competitively relative to foreign producers in industries where exposure to export markets is rising or where there is strong competition for market share because close substitutes for U.S. products are available abroad (for example, in semiconductors).

12. See Melick (1990). Melick has performed a battery of econometric tests to characterize U.S. import pricing behavior. His results highlight the difficulties that arise when using aggregate data to model pricing behavior. Econometric tests rejected the restrictions suggested by three widely used models of import pricing behavior: (i) perfect competition; (ii) Nash imperfect competition; (iii) the mark-up model (as in Hooper and Mann (1989)). Melick attributes this rejection to aggregation problems. In particular, all three types of market structure may be present at the aggregate level. Other tests suggested that the widely used PDL specification with correction for serial correlation may produce spurious instability, but appropriate alternative specifications are not obvious. Additional tests using similar recursive econometric techniques may verify whether the apparent instability in export pricing behavior suggested by Chart 4 is robust to changes in specification and clarify its sources.

13. For a related discussion, see Moreno (1989b). The reader should recall that the trade-weighted foreign CPI measure covers only major industrial countries. A measure that includes the CPIs of a number of developing countries—notably the Asian newly industrializing economies—might indicate a less robust improvement in the competitiveness of U.S. exporters. However, it would still be true that U.S. exporters are more competitive in relation to their industrial country trading partners.

14. Similar results are obtained when using a PDL specification for the export equation, as in the FRBSF structural model. One issue that has not been directly addressed in the paper is whether the single equation estimation techniques used here—which are commonly used in the literature—may account for the tendency to underpredict export volume observed in Chart 1. Since single equation estimates are correct if the elasticity of supply is infinite (or the demand function is stable while the supply function shifts around), one way of justifying the use of single equation techniques is to note that the U.S. domestic production sector is very large in comparison to the export sector, and that supply can therefore shift to the export sector quite easily.

Furthermore, it does not appear that simultaneous equation bias would produce the underprediction of exports obtained in this paper. As pointed out by Goldstein and Khan (1985), single equation estimates can produce weighted averages of demand and supply elasticities and may therefore be biased downward. Consider now the demand function estimated in Table 6. Assuming this function was stable over the period 1988–1989, the U.S. dollar appreciation over much of this period would tend to reduce the demand for U.S. exports. However, if the estimates were subject to simultaneous equation bias, there would be a tendency to *understate* the impact of dollar appreciation in out-of-sample simulations, that is, a tendency to *overpredict* exports. Thus, the underprediction in Chart 1 does not appear to be the result of simultaneous equation bias.

15. The preceding results permit us to rule out another explanation for the tendency to underpredict exports, the phenomenon of "hysteresis." Hysteresis is a situation where a phenomenon (for example, large export volume) persists even when the disturbance that produced it (for example, dollar depreciation) is removed. As applied to the present case, hysteresis would imply that sharp gains in U.S. competitiveness after 1985 produced persistent effects on U.S. exports that are not readily captured in equation (1).

To understand how hysteresis in export markets may arise, suppose that entry and exit from world export markets is characterized by relatively high fixed costs. One implication is that large swings in prices may encourage entry or force exit, while small swings may not. Small swings in U.S. competitiveness (such as those observed up to the early 1980s) would be characterized by changes in export demand that are well-captured by equation (1). However, large swings in U.S. competitiveness (such as the dollar appreciation between 1980–85 and the depreciation that immediately followed) would be accompanied by entry or exit decisions that are not easily explained by equation (1).

Consider the trends revealed in Chart 5. The Chart suggests that the depreciation of the dollar after 1985, in combination with the tendency to restrain increases in the export price, resulted in a net *competitive gain* for U.S. exporters over the decade, in comparison to their industrial country trading partners. In particular, the sharp gains in U.S. competitiveness after 1985 were probably sufficiently large to prompt the exit or deter the entry of foreign competitors (specifically, competitors in industrial countries). Foreign producers may have been dissuaded from entering export markets to compete with U.S. producers even when the dollar appreciated between 1988 and 1989, because the gains in competitiveness U.S. exporters achieved earlier were not entirely eliminated. Such a situation, where U.S. export volume remains high even if the competitiveness of U.S. exporters is being eroded, fits the definition of hysteresis.

However, the effects of hysteresis in explaining robust export growth, if any, are not very strong. Otherwise, the forecast using RXR_2 should also show a persistent tendency to underpredict exports in recent years.

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